

Percent Composition Worksheet

- 1) What is the percent composition of nitrogen in AgNO_3 ?

$$\frac{14g}{107.9g + 14g + 48g} \times 100 = 8.24\%$$

$$\frac{\text{mass of N}}{\text{mass of AgNO}_3} \times 100 =$$

- 2) What is the percent composition of carbon in $\text{C}_2\text{H}_5\text{O}$?

$$\frac{24.0g}{24.0g + 5.0g + 16g} \times 100 = 53.3\%$$

$$\frac{\text{mass of C} \times 2}{\text{mass of C}_2\text{H}_5\text{O}} =$$

- 3) What is the percent composition of hydrogen in H_2SO_4 ?

$$\frac{2g}{2g + 32.1g + 64.0g} \times 100 = 2.04\%$$

- 4) What is the percent composition of sulfur in sulfur hexafluoride? (SF_6)

$$\frac{32.1g}{32.1g + 114.0g} \times 100 = 22.0\%$$

- 5) What is the percent composition of iron in iron (II) sulfide? (FeS)

$$\frac{55.8g}{55.8g + 32.1g} \times 100 = 63.5\%$$

- 6) What is the percent composition of lithium in lithium phosphate? (Li_3PO_4)

$$\frac{20.7g}{20.7g + 31.0g + 64.0g} \times 100 = 17.9\%$$

Name _____

Date _____ Pd _____

Empirical Formulas Worksheet, #1

Directions: Find the empirical formula and name for each of the following.

1. A compound is 24.7% Calcium, 1.2% Hydrogen, 14.8% Carbon, and 59.3% Oxygen. Write the empirical formula and name the compound.

$$24.7g \text{ Ca} \left(\frac{1 \text{ mole Ca}}{40.1g} \right) = \frac{0.6159601}{0.6159601} = 1.00$$

$$1.2g \text{ H} \left(\frac{1 \text{ mole H}}{1.0g \text{ H}} \right) = \frac{1.2}{0.6159601} = 1.95 \sim 2 \quad \text{CaH}_2\text{C}_2\text{O}_6$$

$$14.8g \text{ C} \left(\frac{1 \text{ mole C}}{12.0g} \right) = 12.33333 = 2.02 \sim 2$$

$$59.3g \text{ O} \left(\frac{1 \text{ mole O}}{16.0g} \right) = 3.70625 = 6.02 \sim 2$$

2. A compound is 21.20% Nitrogen, 6.06% Hydrogen, 24.30% Sulfur, and 48.45% Oxygen. Write the empirical formula and name the compound.

$$21.20g \text{ N} \left(\frac{1 \text{ mole N}}{14.0g} \right) = \frac{1.5142857}{0.759375} = 1.99 \sim 2$$

$$6.06g \text{ H} \left(\frac{1 \text{ mole H}}{1.0g} \right) = \frac{6.06}{0.759375} = 7.98 \sim 8 \quad \text{N}_2\text{H}_8\text{SO}_4$$

$$24.30g \text{ S} \left(\frac{1 \text{ mole S}}{32.1g} \right) = \frac{0.759375}{0.759375} = 1$$

$$48.45g \text{ O} \left(\frac{1 \text{ mole O}}{16.0g} \right) = \frac{3.028125}{0.759375} = 3.98 \sim 4$$

3. A compound is 44.82% Potassium, 18.39% Sulfur, and 36.79% Oxygen. Write the empirical formula and name the compound.

$$44.82g \text{ K} \left(\frac{1 \text{ mole K}}{39.1g} \right) = \frac{1.14629156}{0.572897196} = 2.00 \quad \text{K}_2\text{SO}_4$$

$$18.39g \text{ S} \left(\frac{1 \text{ mole S}}{32.1g} \right) = \frac{0.572897196}{0.572897196} = 1$$

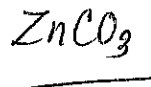
$$36.79g \text{ O} \left(\frac{1 \text{ mole O}}{16.0g} \right) = \frac{2.299375}{0.572897196} = 4.01$$

4. A compound is 52.0% Zinc, 9.6% Carbon, and 38.4% Oxygen. Calculate the empirical formula of the compound.

$$52.0 \text{ g Zn} \left(\frac{1 \text{ mole}}{65.4} \right) = \frac{0.795107}{0.8} = 0.99 \approx 1$$

$$9.6 \text{ g C} \left(\frac{1 \text{ mole}}{12.0 \text{ g}} \right) = \frac{0.8}{0.8} = 1$$

$$38.4 \text{ g O} \left(\frac{1 \text{ mole}}{16.0 \text{ g}} \right) = \frac{2.4}{0.8} = 3$$



5. A compound is 92.2% Carbon and 7.76% Hydrogen. The formula mass of the compound is 78.1 g. Calculate the empirical formula and molecular formula of the compound.

$$92.2 \text{ g C} \left(\frac{1 \text{ mole}}{12.0 \text{ g}} \right) = \frac{7.68}{7.68} = 1$$

$$7.76 \text{ g H} \left(\frac{1 \text{ mole}}{1.0 \text{ g}} \right) = \frac{7.76}{7.68} = 1.01$$

Empirical formula = CH
Empirical mass = 13g

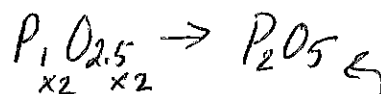
$$\frac{78.1 \text{ g}}{13 \text{ g}} = 6$$

molecular formula = C₆H₆
(Benzene)

6. A compound is 43.7% Phosphorus and 56.3% Oxygen. The formula mass of the compound is 288 g. Calculate the empirical formula and molecular formula of the compound.

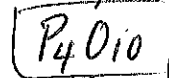
$$43.7 \text{ g P} \left(\frac{1 \text{ mole}}{31.0 \text{ g}} \right) = \frac{1.4}{1.4} = 1.00$$

$$56.3 \text{ g O} \left(\frac{1 \text{ mole}}{16.0 \text{ g}} \right) = \frac{3.51875}{1.4} = 2.51$$



Empirical formula
Empirical mass = 144g
molecular formula =

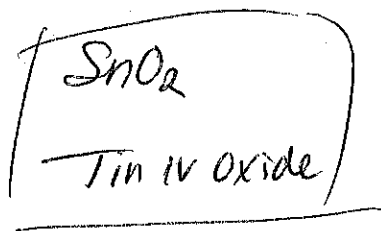
$$288 / 144 = 2$$



7. In an experiment, it was found that 11.775 g of Sn combined with 3.180 g of O. Write the empirical formula and name the compound that is formed.

$$11.775 \text{ g Sn} \left(\frac{1 \text{ mole}}{118.71 \text{ g}} \right) = \frac{0.09919}{0.09919} = 1$$

$$3.180 \text{ g O} \left(\frac{1 \text{ mole}}{16.0 \text{ g}} \right) = \frac{0.19875}{0.09919} = 2$$



1. Benzene, a non-polar solvent used for many applications in industry, and a major component in many organic compounds has the following percent composition:

$$C = 92.3\%$$

$$H = 7.8\%$$

- a. Find Benzene's empirical formula.

$$92.3g C \left(\frac{1 \text{ mole } C}{12.0g} \right) = 7.77 \text{ mol } C$$

$$7.8g H \left(\frac{1 \text{ mole } H}{1.0g} \right) = 7.8 \text{ mol } H$$



- b. Find the Molecular formula of benzene if the entire formula mass is 78.12 g/mol

$$\text{empirical mass} = 12.0 + 1.0 = 13.0g$$

$$78.12/13 = 6$$



2. An unknown sugar is found to have a formula mass of 180.18 g/mol. The sugar contains:

$$40.0\% C, 6.7\% H \text{ and } 53.3\% O.$$

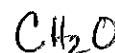
- a. Find the empirical and molecular formula of this sugar. b. What's its name?

$$40.0g C \left(\frac{1 \text{ mol}}{12.0g} \right) = \frac{3.3333}{3.3312} = 1$$

$$53.3g O \left(\frac{1 \text{ mol}}{16g} \right) = \frac{3.3312}{3.3312} = 1$$

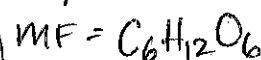
$$6.7g H \left(\frac{1 \text{ mol}}{1g} \right) = \frac{6.7}{3.3312} = 2$$

$$EF =$$



$$EM = 30g$$

$$180.18/30 = 6$$



Glucose

3. Tryptophan - the chemical in turkey that is believed to make you sleepy - has the empirical formula $C_{11}H_{12}N_2O_2$.

Find the molecular formula if the formula mass is 204.25 g/mol.

$$\text{Empirical mass} = (11 \times 12) + (12 \times 1) + (2 \times 14) + (2 \times 16) = 204g$$

$$204.25/204 = 1 \quad \text{Empirical formula} = \text{molecular formula}$$

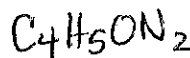
4. Caffeine is made of 49.48% C, 5.19% H, 16.48% O and 28.8% N. Find the molecular formula if its overall molecular mass is 194.22 g/mol

$$49.48g C \left(\frac{1 \text{ mole}}{12.0g} \right) = \frac{4.1233}{1.03} = 4$$

$$5.19g H \left(\frac{1 \text{ mole}}{1.0g} \right) = \frac{5.19}{1.03} = 5$$

$$16.48g O \left(\frac{1 \text{ mole}}{16.0g} \right) = \frac{1.03}{1.03} = 1$$

$$28.8g N \left(\frac{1 \text{ mole}}{14.0g} \right) = \frac{2.0571}{1.03} = 2$$



$$\frac{194.22}{97g} = 2$$

molecular formula =



5. Hydrogen peroxide is 5.93% H and 94.07% O. Find the formula of hydrogen peroxide given it has an overall formula mass of 34 g/mol.

$$5.93g H \left(\frac{1 \text{ mole}}{1.0g} \right) = \frac{5.93}{5.879} = 1$$

$$EF = HO = 17g$$

$$94.07g O \left(\frac{1 \text{ mole}}{16.0g} \right) = \frac{5.879}{5.879} = 1$$

$$\frac{34g}{17g} = 2$$

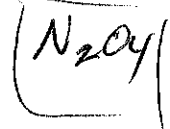
Molecular formula = H_2O_2

6. A strong oxidizing agent and rocket propellant has a % composition of 30.43% N and 69.57% O. Find the molecular formula if its formula mass is 92.0 g/mol.

$$30.43g N \left(\frac{1 \text{ mole}}{14.0g} \right) = \frac{2.17357}{2.17357} = 1$$



$$\frac{92g}{46g} = 2$$



$$69.57g O \left(\frac{1 \text{ mole}}{16.0g} \right) = \frac{4.348125}{2.17357} = 2$$

8. A compound contains 21.6% Na, 33.3% Cl, and 45.1% O. Write the empirical formula and name the compound that is formed.

$$21.6 \text{ g Na} \left(\frac{1 \text{ mol}}{23.0 \text{ g}} \right) = \frac{0.939130}{0.93803} = 1.001 \approx 1$$

$$33.3 \text{ g Cl} \left(\frac{1 \text{ mol}}{35.5 \text{ g}} \right) = \frac{0.93803}{0.93803} = 1$$

$$45.1 \text{ g O} \left(\frac{1 \text{ mole}}{16.0 \text{ g}} \right) = \frac{2.81875}{0.93803} = 3.005 \approx 3$$



Sodium Chlorate

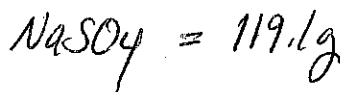
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9.

- A compound is 19.3% Na, 26.9% S, and 53.8% O. Its formula mass is 238 g. What is its molecular formula?

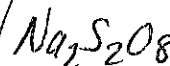
$$19.3 \text{ g Na} \left(\frac{1 \text{ mol}}{23.0 \text{ g}} \right) = \frac{0.83913}{0.838006} = 1$$

$$26.9 \text{ g S} \left(\frac{1 \text{ mol}}{32.1 \text{ g}} \right) = \frac{0.838006}{0.838006} = 1$$

$$53.8 \text{ g O} \left(\frac{1 \text{ mol}}{16 \text{ g}} \right) = \frac{3.3625}{0.838006} = 4$$



$$\frac{238}{119} = 2$$

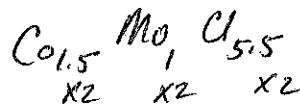


10. An experiment uses a catalyst that is 23.3% Co, 25.3% Mo, and 51.4% Cl. What is the empirical formula of the compound?

$$23.3 \text{ g Co} \left(\frac{1 \text{ mol}}{58.9 \text{ g}} \right) = \frac{0.39559}{0.26382} = 1.5$$

$$25.3 \text{ g Mo} \left(\frac{1 \text{ mol}}{95.9 \text{ g}} \right) = \frac{0.26382}{0.26382} = 1$$

$$51.4 \text{ g Cl} \left(\frac{1 \text{ mol}}{35.5 \text{ g}} \right) = \frac{1.44789}{0.26382} = 5.5$$



x2 x2 x2

